

Application Number 10/020,086
Responsive to Office Action mailed December 17, 2004

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

Claim 1 (Original): A method comprising:

storing a virtual storage map (VSM) to allocate a primary virtual storage and a secondary virtual storage; and

updating the VSM to reallocate the primary virtual storage to include data written to the secondary virtual storage.

Claim 2 (Original): The method of claim 1, wherein the VSM allocates a set of storage units for each virtual storage, and further wherein updating the VSM comprises updating the VSM to reallocate at least one storage unit from the secondary virtual storage to the primary storage device.

Claim 3 (Original): The method of claim 1, further comprising:

receiving a save command; and

updating the VSM in response to the save command.

Claim 4 (Original): The method of claim 3, wherein receiving a save command comprises receiving a signal in response to an actuated hardware switch.

Claim 5 (Original): The method of claim 3, wherein receiving a save command comprises receiving the save command from software executing on a host computer.

Claim 6 (Original): The method of claim 3, wherein receiving a save command comprises receiving a signal from a handheld device.

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Claim 7 (Original): The method of claim 6, wherein receiving the signal from the handheld device comprises receiving a wireless communication from the handheld device.

Claim 8 (Original): The method of claim 1, further comprising:
storing data received from a host computer prior to a time T_0 on the secondary virtual storage.

Claim 9 (Original): The method of claim 8, further comprising storing a record of locations within secondary virtual storage to which the data written has been written.

Claim 10 (Original): The method of claim 9, further comprising selectively reading data from the primary virtual storage and the secondary virtual storage based on the record.

Claim 11 (Original): The method of claim 9, wherein the VSM allocates a set of storage units for each virtual storage, and wherein storing a record comprises storing a delta data map (DDM) to indicate those storage units of the secondary virtual storage to which the data has been written.

Claim 12 (Original): The method of claim 11, wherein the DDM and the VSM comprises bitmaps having a set of binary values, wherein each binary value corresponds to a respective storage unit, and further wherein updating the VSM includes changing a state of at least one of the binary values.

Claim 13 (Original): The method of claim 1, wherein the VSM defines a set of storage units within one or more logical storage volumes, and further wherein the logical storage volumes comprise one or more physical storage mediums.

Claim 14 (Original): The method of claim 1, wherein storing the VSM comprises storing the VSM in a computer-readable medium coupled to a host computer.

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Claim 15 (Original): The method of claim 1, wherein storing the VSM comprises storing the VSM in an embedded memory of a controller coupled to a host computer via an input/output (I/O) bus.

Claim 16 (Original): The method of claim 1, where updating the VSM comprises:
storing a record of locations of the secondary virtual storage to which the data has been written after a time T_0 ;
receiving a save command at a time T_s where $T_s > T_0$; and
in response to the save command, adjusting the VSM to redefine the primary virtual storage to include the data written to the secondary storage device after T_0 .

Claim 17 (Original): The method of claim 1, further comprising:
storing the VSM as a bitmap defining a set of storage units for each virtual storage, wherein each binary value of the bitmap corresponds to a storage unit within each set; and
storing a delta data map (DDM) as a bitmap to indicate those storage units of the secondary virtual storage to which data has been written after a time T_0 .

Claim 18 (Original): The method of claim 17, wherein updating the VSM comprises:
setting each bit of the VSM bitmap based upon an exclusive or operation (XOR) of clearing the corresponding bit within the DDM.

Claim 19 (Original): The method of claim 1, further comprising:
storing the VSM to define a set of storage units for the primary virtual storage and the secondary virtual storage; and
storing status data for each storage unit of secondary virtual storage, wherein the status data indicates whether each storage unit needs to be reallocated.

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Claim 20 (Original): The method of claim 19, wherein updating the VSM comprises:
updating the VSM to reallocate the primary virtual storage during free cycles of a bus;
and
updating the corresponding status data while updating the VSM.

Claim 21 (Original): The method of claim 1, further comprising:
storing the VSM to define a set of storage units for the primary virtual storage and the secondary virtual storage; and
storing version information for the storage units of secondary virtual storage, wherein the version information indicates a current version for each storage unit of the secondary virtual storage.

Claim 22 (Original): The method of claim 21, wherein updating the VSM comprises:
incrementing a system version indicator upon receiving a save command;
in response to a write request to a storage unit of the secondary virtual storage, comparing the system version indicator with the save version for the storage unit indicated by the write request;
reallocating the primary virtual storage based on the comparison; and
updating the version for the storage unit indicated by the write request.

Claim 23 (Currently Amended): An apparatus comprising:
a computer-readable medium to store a virtual storage map (VSM) allocating that represents an allocation of a primary virtual storage and a secondary virtual storage within a storage system; and
a control unit to update the VSM to reallocate the primary virtual storage to include data written to the secondary virtual storage.

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Claim 24 (Original): The apparatus of claim 23, further comprising:

a first interface coupled to the control unit to receive storage requests from a processor;
and

a second interface coupling the control unit to the storage system.

Claim 25 (Original): The apparatus of claim 23, further comprising an input/output (I/O) interface to receive a save command, wherein the control unit reallocates the primary virtual storage in response to the save command.

Claim 26 (Original): The apparatus of claim 25, wherein the I/O interface receives a signal from an actuated switch.

Claim 27 (Original): The apparatus of claim 25, wherein the I/O interface receives a wireless signal.

Claim 28 (Original): The apparatus of claim 25, wherein the I/O interface receives the save command from software executing on a computing device.

Claim 29 (Original): The apparatus of claim 23, wherein the VSM represents allocation of a set of storage units for each virtual storage, and further wherein the control unit reallocates at least one storage unit from the secondary virtual storage to the primary storage device.

Claim 30 (Original): The apparatus of claim 23, wherein the control unit stores data received from a processor prior to a time T_0 on the primary virtual storage, and further wherein the control unit stores data received from the processor after time T_0 on the secondary virtual storage.

Claim 31 (Original): The apparatus of claim 23, wherein the computer-readable medium further stores a record of locations of the secondary virtual storage to which data has been written.

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Claim 32 (Original): The apparatus of claim 31, wherein the control unit selectively reads data from the primary virtual storage and the secondary virtual storage based on the record.

Claim 33 (Original): The apparatus of claim 31, wherein the VSM represents allocation of a set of storage units for each virtual storage, and the record comprises a delta data map (DDM) to indicate those storage units of the secondary virtual storage to which the data has been written.

Claim 34 (Original): The apparatus of claim 33, wherein the DDM and the VSM comprises bitmaps having a set of binary values, wherein the control unit reallocates the primary virtual storage by changing a state of at least one of the binary values.

Claim 35 (Original): The apparatus of claim 34, wherein the control unit reallocates the primary virtual storage by setting each bit of the VSM bitmap based upon an exclusive or (XOR) of the binary value of VSM bit and a corresponding bit within the DDM, and clearing the corresponding bit within the DDM.

Claim 36 (Original): The apparatus of claim 23, wherein the VSM represents allocation of a set of storage units for each of the virtual storages, and further wherein the computer-readable medium stores status data indicating whether each storage unit of the secondary virtual storage needs to be reallocated.

Claim 37 (Original): The apparatus of claim 23, wherein the VSM represents allocation of a set of storage units for each of the virtual storages, and further wherein the computer-readable medium stores version data indicating a current version for each storage unit of the secondary virtual storage.

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Claim 38 (Currently Amended): A system comprising:
a processor;
a storage system having one or more physical storage devices; and
a controller coupled to the processor and the storage system, wherein the controller maintains a virtual storage map (VSM) allocating that represents an allocation of a primary virtual storage and a secondary virtual storage within the storage system.

Claim 39 (Original): The system of claim 38, wherein the controller stores the VSM within the storage system.

Claim 40 (Original): The system of claim 38, wherein the controller stores the VSM within the storage system.

Claim 41 (Previously Presented): The system of claim 38, wherein the controller stores data received from a processor prior to a time T_0 on the primary virtual storage, and further wherein a control unit stores data received from the processor after time T_0 on the secondary virtual storage.

Claim 42 (Original): The system of claim 41, wherein the controller updates the VSM in response to a save command to reallocate the primary virtual storage to include data written to the secondary virtual storage.

Claim 43 (Original): The system of claim 42, further comprising an input/output (I/O) device to issue a save command to the controller.

Claim 44 (Original): The system of claim 43, wherein the I/O device provides a signal to the controller upon actuation of a hardware switch.

Claim 45 (Original): The system of claim 43, wherein the I/O device issues commands to the controller via a wireless signal.

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Claim 46 (Currently Amended): A method comprising:
storing a virtual storage map (VSM) to allocate that represents an allocation of a primary
virtual storage and a secondary virtual storage within a storage system;
receiving requests from a processor to access the storage system; and
selectively filtering unsupported requests including unpublished vendor-specific requests.

Claim 47 (Previously Presented): The method of claim 46, wherein receiving the requests
comprises receiving the requests with a controller coupled between the processor and a storage
device via an input/output (I/O) bus.

Claim 48 (Original): The method of claim 46, wherein storing the VSM comprises storing the
VSM in an embedded memory of a controller coupled to the processor via an input/output (I/O)
bus.

Claim 49 (Currently Amended): A method comprising:
storing a virtual storage map (VSM) to allocate that represents an allocation of a primary
virtual storage and a secondary virtual storage;
storing a record of locations of the secondary virtual storage to which data has been
written after a time T_0 ;
receiving a save command via a wireless communication; and
adjusting the VSM in response to the save command.

Claim 50 (Original): The method of claim 49, wherein adjusting the VSM comprises redefining
the primary virtual storage to include the data written to the secondary storage device after T_0 .

Claim 51 (Original): The method of claim 49, wherein receiving the save command via a
wireless communication comprises receiving a signal from a handheld device.

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Claim 52 (Currently Amended): An apparatus comprising:
a computer-readable medium to store a virtual storage map (VSM) allocating that represents an allocation of a primary virtual storage and a secondary virtual storage within a storage system;
an input/output (I/O); and
a control unit to update the VSM in response to a save command; wherein a controller requires a user to select an operating mode from a default lock mode prior to accepting a save command.

Claim 53 (Original): The apparatus of claim 52, wherein the control unit receives the save command from software executing on a processor within a host computer.

Claim 54 (Currently Amended): A method comprising:
storing a virtual storage map (VSM) to define an allocation of a set of storage units for a primary virtual storage and a secondary virtual storage;
storing history data indicating a sequence of save and restore commands; and
storing version data for the storage units of secondary virtual storage, wherein the version data associates one of the commands within the history data with each of the storage units of the secondary virtual storage.

Claim 55 (Original): The method of claim 54, further comprising:
receiving a save command;
adjusting the VSM in response to the save command; and
updating the history data.

Claim 56 (Original): The method of claim 54, further comprising:
receiving a restore command;
adjusting the VSM in response to the restore command; and
updating the history data.

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Claim 57 (Original): The method of claim 54, further comprising storing a record of locations within the secondary virtual storage to which data has been written after a time T_0 .

Claim 58 (Original): The method of claim 55, wherein adjusting the VSM comprises redefining the primary virtual storage to include the data written to the secondary storage device after T_0 .

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